



Goddard Dynamic Simulator
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<http://fsw.gsfc.nasa.gov/gds>



Goals, Objectives, Benefits

- GDS is a multi-mission spacecraft simulator
 - Used in testing flight software during development and acceptance test
 - Used in testing flight hardware at spacecraft integration and test
- Making it multi-mission reduces single mission cost thru effective reuse



Approach

- Build solid, reusable models
 - Maintain complete GDS test suite, algorithm documents, traceability
- Build solid, reusable hardware interfaces
 - Much harder than software
 - Some hardware interfaces are not reusable, but there is a significant cost saving from those that are.
- Maintain core GDS development team.
 - Build simulator expertise over multiple missions



Approach (continued)

- Software is written in Ada
 - Gives a 2x productivity increase over C++
 - Allows incorporating C, Fortran code from heritage simulators
 - Code structure matches model structure, or hardware structure, with equal ease.
- Extreme programming methods
 - Write unit tests first
 - Continuous code reviews by peers (every CVS checkin)
 - Test the software on the hardware in a dedicated test lab



Approach (continued)

- Three main threads
 - Ground command, ground telemetry, executor
- Object-oriented design
 - Abstract modules for models, hardware, flight software
 - Executor maintains list of modules to execute each cycle
 - Shared data in locked symbol table.



Approach (continued)

- Can run flight software
 - In a separate set of threads
 - Assumes use of OS abstraction layer
 - GDS provides an implementation
 - Flight software interface with hardware actually interfaces with GDS models
 - No changes to flight code (not even #defines, except for endianness)
 - Can be used for development of scripts for testing flight software
 - Not an actual test of flight software; wrong target.



Approach (continued)

- Hardware is modular
 - Commercial PCI cards interface to custom cards
 - Each custom card implements one function: propulsion, digital resistors (thermistors), analog voltage/current (CSS)
 - Some custom cards are multi-mission (propulsion, digital resistors)
 - Some are single-mission (RWA, IRU).



Results, Status, Next Steps

- Status:

- Used for SDO mission
- Planned for HRV mission
 - Integrating with Steve Queen's multi-body/visual output simulator

- Next:

- Integrate other heritage models
- Get more missions.